



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 29, 2026 – 01:24 am BST

PDB ID : 9SJK / pdb_00009sjk
Title : Crystal structure of apo SusDdex (BT3089)
Authors : Feasey, M.; Basle, A.; van den Berg, B.
Deposited on : 2025-08-31
Resolution : 1.65 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

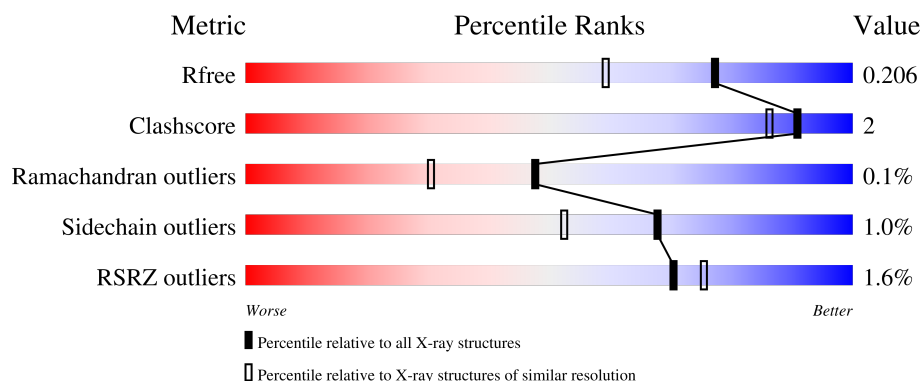
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	2563 (1.66-1.66)
Clashscore	190562	2662 (1.66-1.66)
Ramachandran outliers	187476	2621 (1.66-1.66)
Sidechain outliers	187428	2621 (1.66-1.66)
RSRZ outliers	180081	2564 (1.66-1.66)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	478	2% 91% 5% ..
1	B	478	% 92% 5% ..

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 8702 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called SusD homolog.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	466	Total	C	N	O	S	0	0	0
			3686	2320	632	712	22			
1	B	468	Total	C	N	O	S	0	0	0
			3706	2332	638	714	22			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	27	MET	-	initiating methionine	UNP Q8A366
A	28	GLY	-	expression tag	UNP Q8A366
A	497	LEU	-	expression tag	UNP Q8A366
A	498	GLU	-	expression tag	UNP Q8A366
A	499	HIS	-	expression tag	UNP Q8A366
A	500	HIS	-	expression tag	UNP Q8A366
A	501	HIS	-	expression tag	UNP Q8A366
A	502	HIS	-	expression tag	UNP Q8A366
A	503	HIS	-	expression tag	UNP Q8A366
A	504	HIS	-	expression tag	UNP Q8A366
B	27	MET	-	initiating methionine	UNP Q8A366
B	28	GLY	-	expression tag	UNP Q8A366
B	497	LEU	-	expression tag	UNP Q8A366
B	498	GLU	-	expression tag	UNP Q8A366
B	499	HIS	-	expression tag	UNP Q8A366
B	500	HIS	-	expression tag	UNP Q8A366
B	501	HIS	-	expression tag	UNP Q8A366
B	502	HIS	-	expression tag	UNP Q8A366
B	503	HIS	-	expression tag	UNP Q8A366
B	504	HIS	-	expression tag	UNP Q8A366

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		

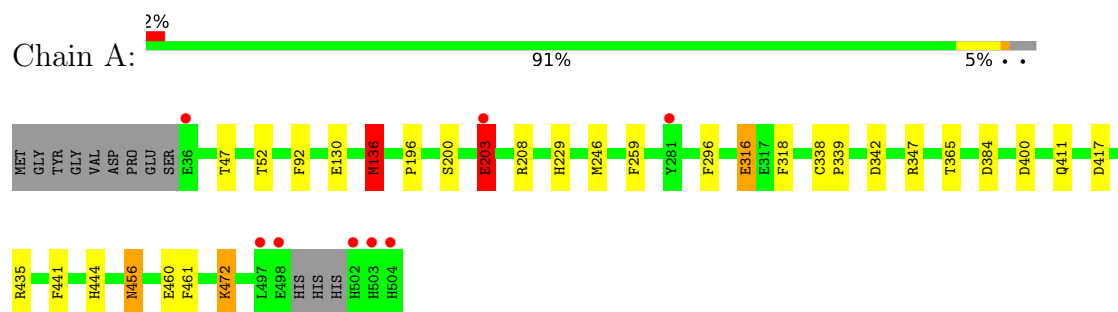
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	624	Total 624	O 624	0	0
3	B	616	Total 616	O 616	0	0

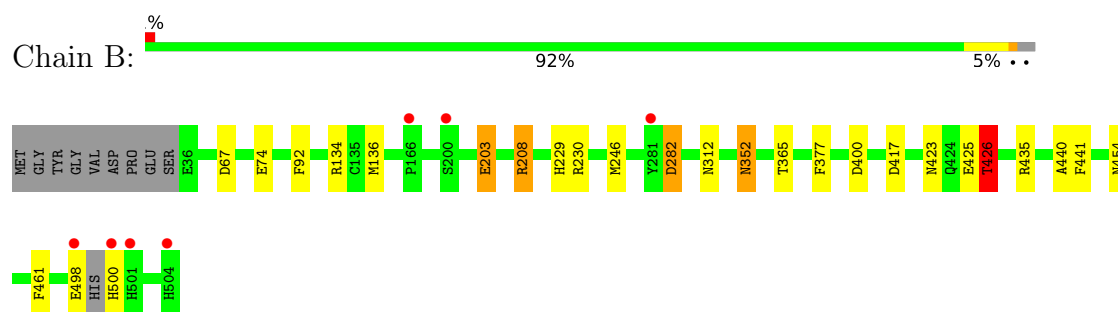
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: SusD homolog



- Molecule 1: SusD homolog



4 Data and refinement statistics

Property	Value
Space group	P 42 21 2
Cell constants a, b, c, α , β , γ	119.50Å 119.50Å 176.98Å 90.00° 90.00° 90.00°
Resolution (Å)	53.44 – 1.65 53.44 – 1.65
% Data completeness (in resolution range)	100.0 (53.44-1.65) 100.0 (53.44-1.65)
R_{merge}	0.15
R_{sym}	(Not available)
$\langle I/\sigma(I) \rangle$ ¹	1.52 (at 1.65Å)
Refinement program	REFMAC 5.8.0430 (refmacat 0.4.88), REFMAC 5.8.0430 (refmacat 0.4.88)
R, R_{free}	0.180 , 0.206 0.181 , 0.206
R_{free} test set	7727 reflections (5.03%)
Wilson B-factor (Å ²)	26.8
Anisotropy	0.383
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 36.4
L-test for twinning ²	$\langle L \rangle = 0.52$, $\langle L^2 \rangle = 0.36$
Estimated twinning fraction	No twinning to report.
F_o, F_c correlation	0.97
Total number of atoms	8702
Average B, all atoms (Å ²)	29.0

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.28% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.75	0/3769	1.20	22/5117 (0.4%)
1	B	0.74	0/3791	1.21	22/5147 (0.4%)
All	All	0.74	0/7560	1.20	44/10264 (0.4%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	2
All	All	0	3

There are no bond length outliers.

All (44) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	136	MET	CG-SD-CE	-17.85	61.62	100.90
1	A	203	GLU	CB-CG-CD	14.10	136.56	112.60
1	B	365	THR	CA-CB-OG1	-9.82	94.87	109.60
1	B	246	MET	CG-SD-CE	-9.19	80.69	100.90
1	B	282	ASP	CA-CB-CG	8.82	121.42	112.60
1	A	316	GLU	CB-CG-CD	-8.16	98.73	112.60
1	A	203	GLU	CB-CA-C	7.22	122.77	110.79
1	A	246	MET	CG-SD-CE	-7.21	85.04	100.90
1	A	365	THR	CA-CB-OG1	-7.01	99.09	109.60
1	A	460	GLU	CB-CG-CD	6.95	124.41	112.60
1	B	352	ASN	CA-CB-CG	6.86	119.46	112.60
1	B	377	PHE	CA-CB-CG	-6.67	107.13	113.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	461	PHE	CA-CB-CG	-6.66	107.14	113.80
1	B	426	THR	CA-CB-OG1	6.49	119.33	109.60
1	B	441	PHE	CA-CB-CG	-6.19	107.61	113.80
1	A	92	PHE	CA-CB-CG	-6.18	107.62	113.80
1	A	441	PHE	CA-CB-CG	-6.10	107.70	113.80
1	B	425	GLU	CB-CA-C	-6.09	100.50	110.85
1	B	203	GLU	CB-CA-C	5.97	121.68	110.63
1	B	136	MET	CB-CA-C	5.96	120.69	110.79
1	B	230	ARG	CB-CG-CD	5.90	124.87	111.30
1	B	134	ARG	NE-CZ-NH1	-5.86	115.64	121.50
1	B	417	ASP	CA-CB-CG	5.86	118.46	112.60
1	B	230	ARG	CD-NE-CZ	5.72	132.41	124.40
1	B	136	MET	CG-SD-CE	-5.63	88.51	100.90
1	B	461	PHE	CA-CB-CG	-5.59	108.20	113.80
1	B	92	PHE	CA-CB-CG	-5.57	108.23	113.80
1	A	208	ARG	CD-NE-CZ	5.56	132.18	124.40
1	A	384	ASP	CA-CB-CG	5.55	118.15	112.60
1	B	426	THR	OG1-CB-CG2	5.54	120.38	109.30
1	A	400	ASP	CA-CB-CG	5.54	118.14	112.60
1	A	417	ASP	CA-CB-CG	5.51	118.11	112.60
1	A	47	THR	CA-CB-OG1	-5.35	101.58	109.60
1	A	342	ASP	CB-CA-C	-5.33	104.02	111.80
1	A	456	ASN	CA-CB-CG	-5.26	107.33	112.60
1	B	136	MET	CB-CG-SD	-5.23	97.01	112.70
1	B	425	GLU	N-CA-CB	5.21	117.88	110.16
1	A	130	GLU	CB-CG-CD	5.16	121.37	112.60
1	A	259	PHE	CA-CB-CG	-5.11	108.69	113.80
1	A	444	HIS	CA-CB-CG	-5.09	108.70	113.80
1	A	296	PHE	CA-CB-CG	-5.08	108.72	113.80
1	B	208	ARG	CD-NE-CZ	5.07	131.50	124.40
1	A	203	GLU	N-CA-CB	-5.05	102.70	110.12
1	B	400	ASP	CA-CB-CG	5.03	117.63	112.60

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	435	ARG	Sidechain
1	B	208	ARG	Sidechain
1	B	435	ARG	Sidechain

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3686	0	3536	12	0
1	B	3706	0	3550	12	0
2	A	25	0	0	1	0
2	B	45	0	0	1	0
3	A	624	0	0	5	0
3	B	616	0	0	9	0
All	All	8702	0	7086	24	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 2.

All (24) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:74:GLU:HG2	3:B:916:HOH:O	0.89	1.07
1:B:423:ASN:OD1	1:B:426:THR:HG23	1.56	1.06
1:A:347:ARG:HD3	2:A:605:SO4:O3	1.61	0.99
1:B:352:ASN:ND2	2:B:606:SO4:O2	1.96	0.98
1:B:229:HIS:HE1	3:B:1091:HOH:O	1.48	0.96
1:B:352:ASN:OD1	3:B:701:HOH:O	1.92	0.87
1:B:282:ASP:CG	3:B:703:HOH:O	2.24	0.81
1:B:67:ASP:OD2	3:B:702:HOH:O	1.99	0.79
1:A:229:HIS:HE1	3:A:1155:HOH:O	1.68	0.76
1:B:282:ASP:OD1	3:B:703:HOH:O	2.04	0.76
1:B:440:ALA:HA	3:B:702:HOH:O	1.91	0.71
1:A:203:GLU:CD	1:A:203:GLU:H	2.04	0.65
1:A:318:PHE:HZ	3:A:833:HOH:O	1.83	0.60
1:B:74:GLU:CG	3:B:916:HOH:O	1.72	0.60
1:B:498:GLU:O	1:B:500:HIS:N	2.44	0.50
1:A:411:GLN:HG2	3:A:710:HOH:O	2.10	0.50
1:A:411:GLN:CG	3:A:710:HOH:O	2.61	0.49
1:A:456:ASN:OD1	1:A:472:LYS:NZ	2.48	0.45
1:B:352:ASN:HA	3:B:701:HOH:O	2.16	0.44
1:A:472:LYS:HG3	3:A:1027:HOH:O	2.19	0.43
1:A:136:MET:CA	1:A:136:MET:HE3	2.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:196:PRO:HB2	1:A:200:SER:OG	2.21	0.41
1:A:136:MET:HE3	1:A:136:MET:HA	2.03	0.40
1:A:338:CYS:HB2	1:A:339:PRO:HD2	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	462/478 (97%)	453 (98%)	9 (2%)	0	100	100
1	B	464/478 (97%)	455 (98%)	8 (2%)	1 (0%)	43	27
All	All	926/956 (97%)	908 (98%)	17 (2%)	1 (0%)	48	30

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	312	ASN

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	392/402 (98%)	387 (99%)	5 (1%)	61	42
1	B	394/402 (98%)	391 (99%)	3 (1%)	73	60

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
All	All	786/804 (98%)	778 (99%)	8 (1%)	68	52

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	52	THR
1	A	136	MET
1	A	203	GLU
1	A	316	GLU
1	A	472	LYS
1	B	203	GLU
1	B	426	THR
1	B	454	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	204	ASN
1	A	229	HIS
1	A	265	ASN
1	A	274	GLN
1	A	398	HIS
1	B	229	HIS
1	B	265	ASN
1	B	274	GLN
1	B	401	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

14 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	SO4	B	606	-	4,4,4	0.34	0	6,6,6	0.15	0
2	SO4	B	602	-	4,4,4	0.34	0	6,6,6	0.47	0
2	SO4	B	605	-	4,4,4	0.32	0	6,6,6	0.09	0
2	SO4	A	602	-	4,4,4	0.32	0	6,6,6	0.20	0
2	SO4	A	604	-	4,4,4	0.33	0	6,6,6	0.10	0
2	SO4	B	601	-	4,4,4	0.38	0	6,6,6	0.28	0
2	SO4	B	607	-	4,4,4	0.28	0	6,6,6	0.05	0
2	SO4	B	604	-	4,4,4	0.34	0	6,6,6	0.17	0
2	SO4	B	608	-	4,4,4	0.34	0	6,6,6	0.07	0
2	SO4	B	609	-	4,4,4	0.35	0	6,6,6	0.20	0
2	SO4	A	605	-	4,4,4	0.35	0	6,6,6	0.09	0
2	SO4	B	603	-	4,4,4	0.22	0	6,6,6	0.20	0
2	SO4	A	603	-	4,4,4	0.25	0	6,6,6	0.36	0
2	SO4	A	601	-	4,4,4	0.36	0	6,6,6	0.39	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	606	SO4	1	0
2	A	605	SO4	1	0

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	466/478 (97%)	-0.16	8 (1%) 69 74	20, 26, 37, 70	0
1	B	468/478 (97%)	-0.11	7 (1%) 72 77	20, 27, 39, 71	0
All	All	934/956 (97%)	-0.13	15 (1%) 70 75	20, 26, 39, 71	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	504	HIS	3.9
1	B	500	HIS	3.5
1	B	498	GLU	3.4
1	A	503	HIS	3.3
1	A	502	HIS	3.1
1	B	501	HIS	3.0
1	B	281	TYR	3.0
1	B	200	SER	2.3
1	A	497	LEU	2.3
1	A	498	GLU	2.3
1	A	203	GLU	2.2
1	B	166	PRO	2.2
1	B	504	HIS	2.2
1	A	36	GLU	2.1
1	A	281	TYR	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	SO4	B	609	5/5	0.78	0.13	54,56,64,76	0
2	SO4	B	608	5/5	0.80	0.09	83,87,90,92	0
2	SO4	B	606	5/5	0.82	0.12	59,61,69,81	0
2	SO4	B	603	5/5	0.84	0.11	52,70,75,81	0
2	SO4	A	605	5/5	0.84	0.09	70,71,79,87	0
2	SO4	B	607	5/5	0.88	0.09	47,62,74,76	0
2	SO4	A	604	5/5	0.90	0.09	50,64,70,79	0
2	SO4	A	603	5/5	0.91	0.09	39,59,61,61	0
2	SO4	B	605	5/5	0.91	0.09	38,56,60,62	0
2	SO4	B	604	5/5	0.92	0.08	45,67,73,78	0
2	SO4	B	601	5/5	0.94	0.09	33,42,50,51	0
2	SO4	A	602	5/5	0.95	0.07	37,44,51,53	0
2	SO4	B	602	5/5	0.97	0.07	29,29,36,37	0
2	SO4	A	601	5/5	0.97	0.07	28,29,37,38	0

6.5 Other polymers [i](#)

There are no such residues in this entry.